

UCRL-95128
PREPRINT

THE Be-Pa (BERYLLIUM-PROTACTINIUM) SYSTEM

H. Okamoto
L. E. Tanner
D. E. Peterson

CIRCULATION COPY
SUBJECT TO RECALL
IN TWO WEEKS

This paper was prepared for submittal to
Bulletin of Alloy Phase Diagrams

August 15, 1986

Lawrence
Livermore
National
Laboratory

This is a preprint of a paper intended for publication in a journal or proceedings. Since changes may be made before publication, this preprint is made available with the understanding that it will not be cited or reproduced without the permission of the author.

DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

The Be-Pa (Beryllium-Protactinium) System

9.01218 231.036

By H. Okamoto and L. E. Tanner
Lawrence Livermore National Laboratory
and
D. E. Peterson
Los Alamos National Laboratory

Equilibrium Diagram

The melting point of βBe and the $\beta\text{Be} \rightarrow \alpha\text{Be}$ allotropic transformation temperature are 1289 ± 4 and 1270 ± 6 °C, respectively [86BAP]. The corresponding values for βPa and αPa are 1572 and 1170 °C, respectively [85War].

Only one compound, Be_{13}Pa , exists in the Be-Pa system as in other Be-Actinide systems [75Ben]. The melting point of Be_{13}Pa is not known.

Crystal Structures

The crystal structure and lattice parameter data are given in Table 1. The structure of Be_{13}Pa is isomorphous to NaZn_{13} [75Ben].

Cited References

- *75Ben: U. Benedict, K. Buijs, C. Dufour, and J.Cl. Toussaint, "Preparation and X-ray Diffraction Study of PaBe_{13} , AmBe_{13} and CmBe_{13} ", J. Less-Common Met., **42**(3), 345-354 (1975). (Equi Diagram, Crys Structure; Experimental)
- 78Boh: J. Bohet and W. Muller, "Preparation and Structure Studies of 'Van Arkel' Protactinium", J. Less-Common Met., **57**, 185-199 (1978). (Crys Structure; Experimental)
- 85War: J.W. Ward, P.D. Kleinschmidt, and D.E. Peterson, "Thermochemical Properties of the Actinide Elements and Selected Actinide-Noble Metal Intermetallics," Handbook of the Physics and Chemistry of the Actinides, C. Keller and A. Freeman, Ed., North-Holland, Amsterdam (1985). (Equi Diagram; Review)
- 86BAP: to be published in Bull. Alloy Phase Diagrams, (1986). (Equi Diagram; Compilation)

* Indicates key paper.

General References

- [King1]: H.W. King, "Crystal Structures of the Elements at 25 °C", Bull. Alloy Phase Diagrams, 2(3), 401-402 (1981)
- [King2]: H.W. King, "Temperature-Dependent Allotropic Structures of the Elements", Bull. Alloy Phase Diagrams, 3(2), 275-276 (1982)

Acknowledgments

Be-Pa evaluation contributed by L.E. Tanner, L-217, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA 94550, H. Okamoto, B77G, Lawrence Berkeley Laboratory, Berkeley, CA 94720, and D.E. Peterson, Los Alamos National Laboratory, Los Alamos, NM 87545. Work was partially supported by American Society for Metals (ASM) and the National Bureau of Standards (NBS). Literature searched through 1985. Part of the bibliographic search was provided by ASM. L.E. Tanner and H. Okamoto are the ASM/NBS Data Program Category Editors for binary beryllium alloys, and D.E. Peterson is the Category Editor for binary actinide alloys. Work was performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

Table 1 Be-Pa Crystal Structure and Lattice Parameter Data

Phase	Composition, at.% Pa	Struktur-		Space group	Proto- type	Lattice parameters, nm		Reference
		Pearson symbol	bericht designation			a	c	
(β Be)....	0	cI2	A2	Im3m	W	0.25515	...	[King2]
(α Be)....	0	hP2	A3	P6 ₃ /mmc	Mg	0.22857	0.35839	[King1]
Be ₁₃ Pa...	7.14	cF112	D2 ₃	Fm3c	NaZn ₁₃	1.02607±25	...	[75Ben]
(β Pa)...	100	cF4	A1	Fm3m	Cu	0.5018	...	[78Boh]
(α Pa)...	100	tI2	...	I4/mmm	Pa	0.3921	0.3235	[78Boh]